# tekmar® - Data Brochure

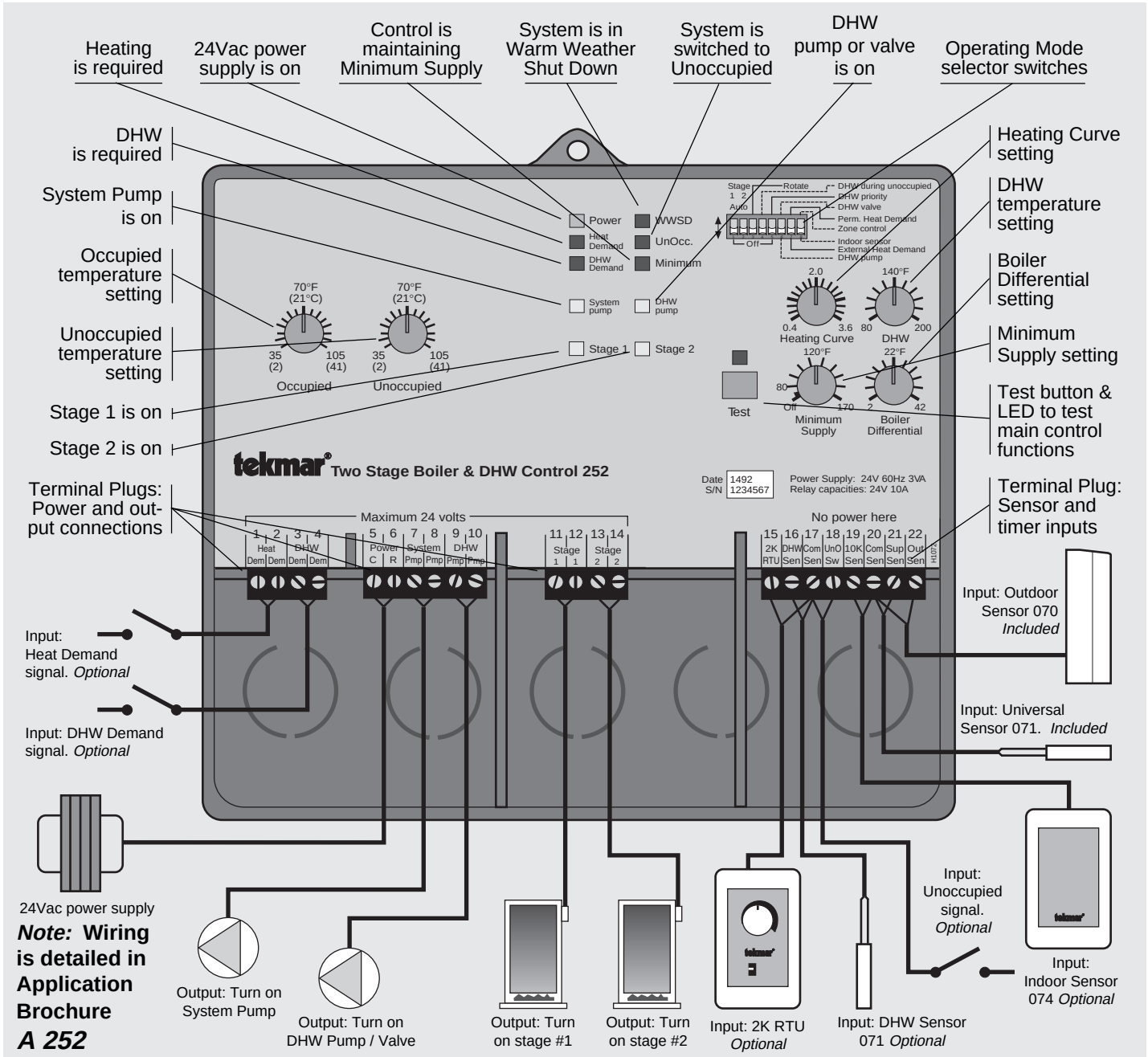
Two Stage Boiler & DHW Control 252

**D 252**

10/92


The tekmar Two Stage Boiler & DHW Control 252 is a microprocessor-based control which regulates the supply water temperature from one or two boilers by turning them on or off. The supply temperature is based on the outdoor, and optionally, the indoor air temperatures. When Domestic Hot Water (DHW) is required, the control will operate the boiler(s) to regulate the supply water temperature in order to satisfy the DHW requirements.





## Outdoor Reset Strategy

### Correct setting and shifting of the Heating Curve... the key to More Comfort and Energy Savings.

#### Heating Curve

As outdoor temperatures become colder, heat losses from a building increase, which requires the addition of more heat to prevent the indoor air temperature from also becoming colder. This tekmar reset control measures the outdoor temperature and as the outdoor temperature becomes colder, it balances the heat loss by making the heating supply water hotter.
The Heating Curve is used to calculate exactly how hot to make the supply water at different outdoor temperatures. It determines the number of degrees the supply water temperature is raised for each degree the outdoor temperature falls.

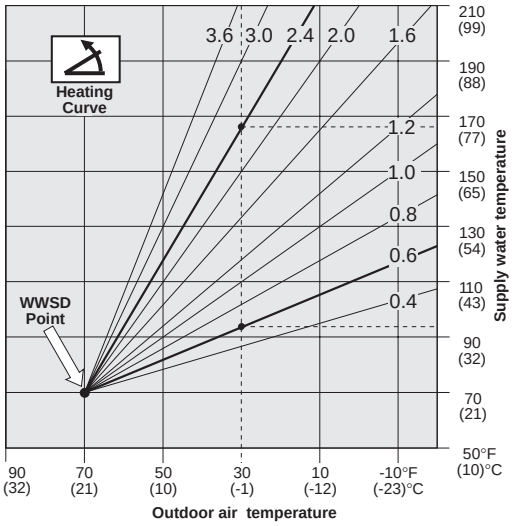
#### *Setting the Heating Curve*

Two examples of how the Heating Curve works are illustrated in the following diagram.

—With a 2.4 Curve, the supply water temperature is raised 2.4 degrees for every degree of outdoor temperature drop.
If: WWSD point = 70°F and Outdoor temperature = 30°F, then supply temperature = 166°F

—With a 0.6 Curve, the supply water temperature is raised 0.6 degrees for every degree of outdoor temperature drop.
If: WWSD point = 70°F and Outdoor temperature = 30°F, then supply temperature = 94°F

- *If the Heating Curve selected is too low;* the heating system will not supply hot enough water to keep the room temperature warm during colder weather.
- *If the Heating Curve selected is too high;* the supply water will be too hot for the conditions and the building will overheat during colder weather.



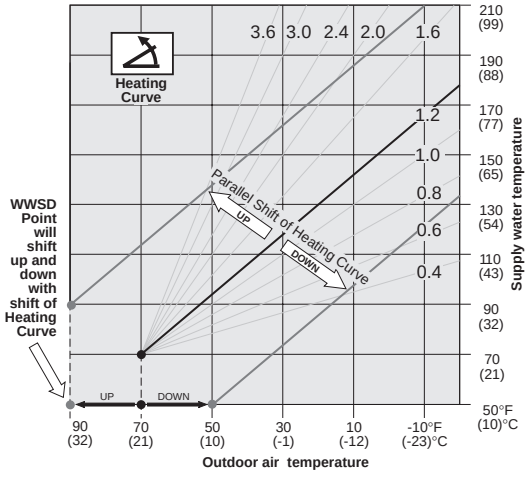

#### *Warm Weather Shut Down (WWSD)*

At warm outdoor temperatures, the indoor space of a building gains heat from the outdoors; additional heat is not required, and if the heating system is running (even on standby), enough excess heat can be produced to overheat the building, causing discomfort and wasting valuable energy.
This control shuts off the boiler(s) and system pump when the outdoor temperature is above the WWSD point.

As outdoor temperatures get colder, there comes a point where the heat gain turns into heat loss; the heat loss causes the indoor temperature to fall below the comfort level, and the heating system must be turned on to start delivering heat.

To provide heat to the building, this control turns on the system pump and cycles the boiler(s) to deliver heat at the low output required by the Heating Curve near the WWSD point.

*When the system is operating near the WWSD point and the building is too cold;* the WWSD point should be raised.
*When the system is operating near the WWSD point and the building is too warm;* the WWSD point should be lowered.




#### *Shifting the Heating Curve*

*(a) Manually, at the control:*

The Occupied and Unoccupied dials on this control can shift the WWSD point up or down from 35 to 105°F (2 to 41°C).

*(b) Automatically, using room temperature feedback:*

In addition to a Supply Sensor and an Outdoor Sensor, this control can use a tekmar RTU, Zone Control or Indoor Sensor to provide room temperature feedback for added comfort and system flexibility.

The control still calculates a desired supply temperature based on the Heating Curve setting and the outdoor temperature.

If the air temperature in the room is too cold, the control will shift the Heating Curve (and WWSD point) *up,* which raises the supply temperature until the room warms up again.

If the air temperature in the room is too warm, the control will shift the Heating Curve (and WWSD point) *down,* which lowers the supply temperature until the room cools down.

A very cool room temperature can shift the curve far enough up to bring the control out of WWSD at warm outdoor temperatures.
A very warm room temperature can shift the curve far enough down to put the control into WWSD at cool outdoor temperatures.

*Refer to the tekmar Essays E 001 and E 002 for more detailed information regarding control strategy and integration of control functions.*

## Sequence of Operation

When the Two Stage Boiler & DHW Control 252 is powered-up, the "Power" light will come on and the control will cycle through an automatic test routine described in detail on pages 10 and 11 of this brochure. When the test routine is completed and no errors are detected, the control exits the test routine and enters the operating mode.

Once in operating mode, the control uses the Outdoor Sensor 070 to continually monitor the outdoor temperature and the Universal Sensor 071 to continually monitor the system supply water temperature. An optional Universal Sensor 071 can be installed to allow the control to monitor a DHW tank temperature.

Indoor temperature can be monitored through the use of;

(a) - a tekmar Zone Control (switch selector switch to "Zone Control" position), **or**;

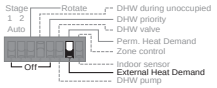
(b) - an Indoor Sensor 074 or a tekmar 2k RTU (switch selector switch to "Indoor Sensor" position).

While monitoring all of these temperatures, the control recognizes the following temperature conditions and inputs and will respond as described. During operation, the lights of the control will indicate operational status as illustrated.

### *Heating Operation*

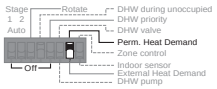
***Heat Demand signal*** *Selector switch = External Heat Demand*

(a) - A heat demand signal is caused by either 24Vac applied to terminals Heat Dem — Heat Dem (1 and 2), or a 10K Zone Control connected to terminals 10K Sen — Com Sen (19 and 20),or both.



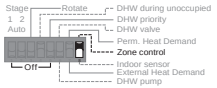

**OR** *Selector switch = Perm. Heat Demand*

(b) - A heat demand signal is either continuously present or, when a 10K Zone Control is connected, then a heat demand signal is only present when the Zone Control calls for heat.




***tekmar Zone Control function*** *Selector switch = Zone Control*

The control will monitor the indoor temperatures of all zones, as well as the outdoor and supply temperatures, and shift the Heating Curve (and the WWSD point) up or down to fine adjust the system supply water temperature for whichever zone requires the hottest supply water. The Occupied and Unoccupied dials are not functional.

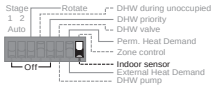



***Occupied/Unoccupied dial function (no indoor temperature feedback)***

The control will monitor the outdoor and supply temperatures. The Occupied or Unoccupied dial settings become the WWSD point. When the outdoor temperature is warmer than the setting of the Occupied dial, the control enters WWSD. When switched into Unoccupied mode, the "Unoccupied' light will come on, and the control will operate at the temperature of the Unoccupied dial setting.

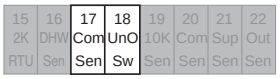
***Indoor Sensor 074 function*** *Selector switch = Indoor Sensor*

The control will monitor the indoor, outdoor and supply temperatures, shifting the Heating Curve (and the WWSD point) up or down to fine adjust the system supply water temperature whenever the room temperature is different than the setting of the Occupied dial. In the Unoccupied mode, the "Unoccupied" light will come on, and the control will maintain the room at the temperature of the Unoccupied dial setting.



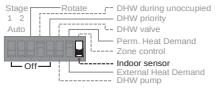

***Unoccupied mode***

Connect (short circuit) terminals *Com Sen — UnO Sw* (17 and 18) together. The Occupied dial becomes inactive. The Unoccupied dial becomes active



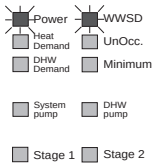

***2K RTU function*** *Selector switch = Indoor Sensor*

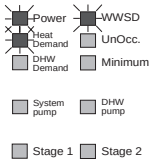
The control will monitor the indoor, outdoor and supply temperatures, and shift the Heating Curve (and the WWSD point) up or down to fine adjust the system supply water temperature whenever the room temperature is different than the setting of the RTU dial. The Occupied and Unoccupied dials are not functional, and a setback RTU must be used if Unoccupied schedules are desired.




***WWSD function***

When WWSD occurs, the "WWSD" light will come on, and the control will continue to monitor the outdoor temperature, supply temperature and indoor temperature (optional). Whenever 3 days pass with the control in uninterrupted WWSD, the system pump will be cycled on for 20 seconds to help prevent it from seizing up.

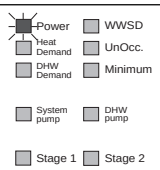


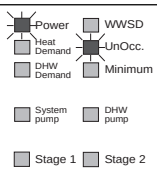




***Outdoor temperature cold enough to require heating***

***No heat demand signal***

When the outdoor temperature is colder than the WWSD point, the control will leave WWSD. Whenever the control leaves WWSD, the "WWSD" light will turn off and the control will continue to monitor the outdoor temperature, supply temperature and indoor temperature (optional), but no further control action will take place until there is a heat demand signal.



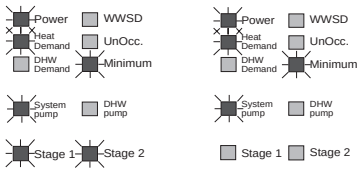




***With Heat demand signal***

The "Heat Demand" light will come on, the control will switch on the system pump and calculate the desired supply temperature based on the requirements of the Heating Curve or the Minimum Supply setting, whichever is highest.

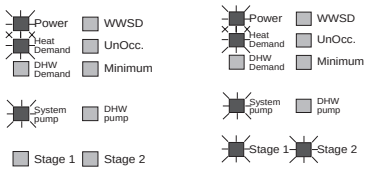
### *Heating Operation (cont.) — Outdoor temperature cold enough to require heating*

#### *With boiler minimum setting higher than heating curve requirement*




The "Minimum" light will come on and the control will switch on the boiler(s). The boiler(s) will fire until the supply temperature reaches the minimum setting plus the differential setting. When this point is reached, the "Minimum" light will stay on and the control will cycle the boiler(s) to maintain the supply water above the Minimum setting.

#### *Outdoor temperature cold enough for heating curve operation*

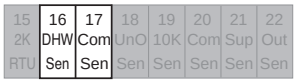



The "Stage" light(s) will come on and the control will fire the boiler(s). The boiler(s) will fire until the supply temperature reaches the heating curve desired temperature plus one half the differential setting, where the "Stage" light(s) will turn off and the boiler(s) will be shut off.

*Note:* Whenever the boiler(s) are turned off, the control will keep them off until at least the minimum time delay has expired *(1 minute to 5 minutes depending on degree of error).*

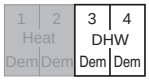
## *DHW Operation*

### *DHW* mode using DHW Sensor 071



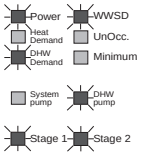

- A DHW Sensor 071 must be installed in terminals *DHW Sen — Com Sen* (16 and 17).
- The DHW Sensor causes the control to monitor the DHW tank temperature. The control generates a DHW demand when 5 minutes has elapsed from the last DHW operation and the tank temperature is dropping quickly, or over a longer period of time when the tank temperature becomes cooler than the DHW dial setting. This DHW demand causes the control to maintain the supply water temperature at the DHW dial setting + 20°F(11°C), and over time will increase the supply temperature to the DHW dial setting + 40°F(22°C).

### *DHW* mode using external DHW Aquastat (no DHW Sensor)



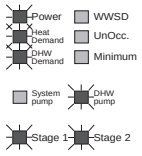

- A 24Vac DHW Demand signal must be applied to terminals *DHW Dem — DHW Dem* (3 and 4).
- The DHW Demand signal causes the control to maintain a supply water temperature at the DHW dial setting, and over time can increase the supply temperature to the DHW dial setting + 20°F(11°C) .

### *DHW operation when control is not in heating mode*



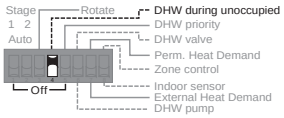

When there is a DHW demand, the "DHW Demand" light will come on and the control will operate the DHW pump or System pump and DHW valve to generate DHW. The boiler(s) will be cycled to maintain the temperature required by the DHW dial setting (above). When DHW demand is removed, the boiler(s) are turned off but the pump continues to run for 1 minute to purge the remaining heat from the boiler(s).

### *DHW operation when control is in heating mode*




When a DHW demand occurs, the "DHW Demand" light will come on and the control will operate the DHW pump or System pump and DHW valve to generate DHW. The control will compare the heating curve desired supply temperature against the DHW desired supply temperature and operate the boiler(s) to maintain the supply at whichever is the hotter desired temperature.

### *DHW during unoccupied* *selector switch #4 = On*




When in Unoccupied mode, the control will operate (as above), to generate DHW.

### *No DHW during unoccupied* *selector switch #4 = Off*

DHW will not be generated in Unoccupied mode, even with a DHW Demand signal.

# Installation

### *Caution*

**Improper installation and operation of this control could result in damage to equipment and possibly even personal injury. It is your responsibility to ensure that this control is safely installed according to all applicable codes and standards.**

## Step One — Getting ready

Check the contents of this package. If any of the contents listed are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or tekmar sales agent for assistance.

*Type 252 includes:*
- One Control 252 • One Outdoor Sensor 070 • One Universal Sensor 071
- One Data Brochure D 252 • One Data Brochure D 001 • One Application Brochure A 252

*Other information available:*
- Essay E 001 • Essay E 002

## *Read Application Brochure A 252 and select the correct Application for your job.*

***Note:***

*Carefully read the details of the Application, and the Sequence of Operation sections in all applicable brochures to ensure that you have chosen the proper control, and you understand its functions within the operational requirements of your system.*

## Step Two — Mounting the base

The control should be removed from its base by pressing down on the release clip in the wiring chamber and sliding upwards on the control. The base is then mounted in accordance with the instructions in the Data Brochure D 001.

## Step Three — Rough-in Wiring

All electrical wiring terminates in the control base wiring chamber. It has standard 7/8" (22mm) knock-outs that will accept common wiring hardware and conduit fittings. Before breaking out the knock-outs, check the wiring diagram and select those sections of the chamber with common voltages, since the safety dividers will later prevent wiring from crossing between sections. Standard 18 to 22 AWG solid wire is recommended for all low voltage wiring to tekmar controls. Heavier guage wire may not fit properly into the terminal plugs, while lighter guage wire is too fragile and may also contribute too much resistance to the circuit.

**Power should not be applied to any of the wires, during this rough-in wiring stage.**

- Install the Outdoor Sensor 070, and the Universal Sensor 071 according to the instructions in the Data Brochure D 001 and run the wiring back to the control. *Options:* A DHW Sensor 071 can be connected. An Indoor Sensor 074, RTU or tekmar Zone Control can also be connected ***(all purchased separately)***. See individual sensor instructions.
- Install the wiring from the other system components; Boiler(s), Pump relays, Heat Demand circuit, etc., to the base.
- Install a 24Vac Class II transformer with a minimum 12VA rating close to the control, and run the wiring from the transformer to the base. *A Class II transformer must be used. Do not connect any of the transformer terminals to ground, as damage to the control may result.*

## Step Four — Electrical connection to the control

*Power and output connections*

***The installer should test to confirm that no voltage is present at any of the wires.***

**Maximum 24 Volts**

- Install the control into the base, sliding it down until it snaps into place.
- All electrical connections are made directly to the terminal plugs.
- Connect the 24Vac power supply from the secondary side of a 24Vac class II transformer to terminals *C — R* (5 and 6). *Do not connect either of the transformer terminals to ground.*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Connect the System Pump circuit to terminals *System Pmp* (7 and 8). These terminals lead to a dry relay contact which closes when the control requires System Pump operation.


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If a DHW pump or valve is to be operated by the control, connect its circuit to terminals *DHW Pmp* (9 and 10). These terminals lead to a dry relay contact which closes when the control requires DHW pump / valve operation.

***Note:*** **The 252 is approved for low voltage only (maximum 24Vac). Line voltages to the pump(s) must be switched through isolation relay(s).**


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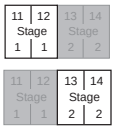
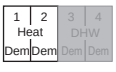
Connect the boiler circuit(s) to terminals *Stage 1* (11 and 12) and *Stage 2* (13 and 14). Each set of terminals lead to a dry relay contact which closes when the control requires boiler operation. Boilers with a 24Vac control circuit can be switched directly through the control. If higher voltages are used, isolation relays must be installed.




*Powered input connections*

If a 24Vac external Heat Demand signal is used, (zone valve end switches, etc.) connect the wiring from the Heat Demand circuit to terminals *Heat Dem — Heat Dem* (1 and 2). When 24Vac is applied to these terminals, the control will recognize a "call for heat" from the system.

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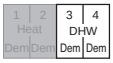
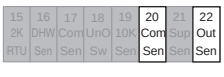
If no DHW Sensor is installed, but a 24Vac DHW Demand signal from an aquastat is used, connect the wiring from the DHW Demand circuit to terminals *DHW Dem — DHW Dem* (3 and 4). When 24Vac is applied to these terminals, the control will recognize a "call for Domestic Hot Water" and switch into DHW mode.




*Sensor and **unpowered** input connections*

***Power should never be applied to these terminals. Damage to the control will result.***

Connect the two wires from the Outdoor Sensor 070 to terminals *Com Sen — Out Sen* (20 and 22).

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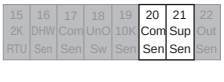
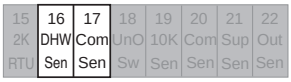
Connect the two wires from the Universal Sensor 071 to terminals *Com Sen — Sup Sen* (20 and 21).



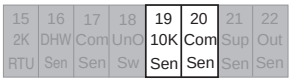
*Option: DHW Sensor 071 input:*

Install the DHW sensor in a well in the lower half of the DHW storage tank. Connect the two wires from a Sensor 071 to terminals *DHW Sen — Com Sen* (16 and 17).



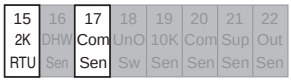

*Option: Indoor temperature feedback sensor:* ***(Choose one option only)***

(1) Connect the two wires from an Indoor Sensor 074 or a tekmar 10K Zone Control to terminals *10K Sen — Com Sen* (19 and 20).



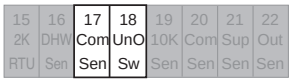

***OR*** **OR**

(2) Connect the two wires from a tekmar 2K RTU, (305, 307, 308, or 310) or a tekmar 240 Zone Control to terminals *2K RTU — Com Sen* (15 and 17).

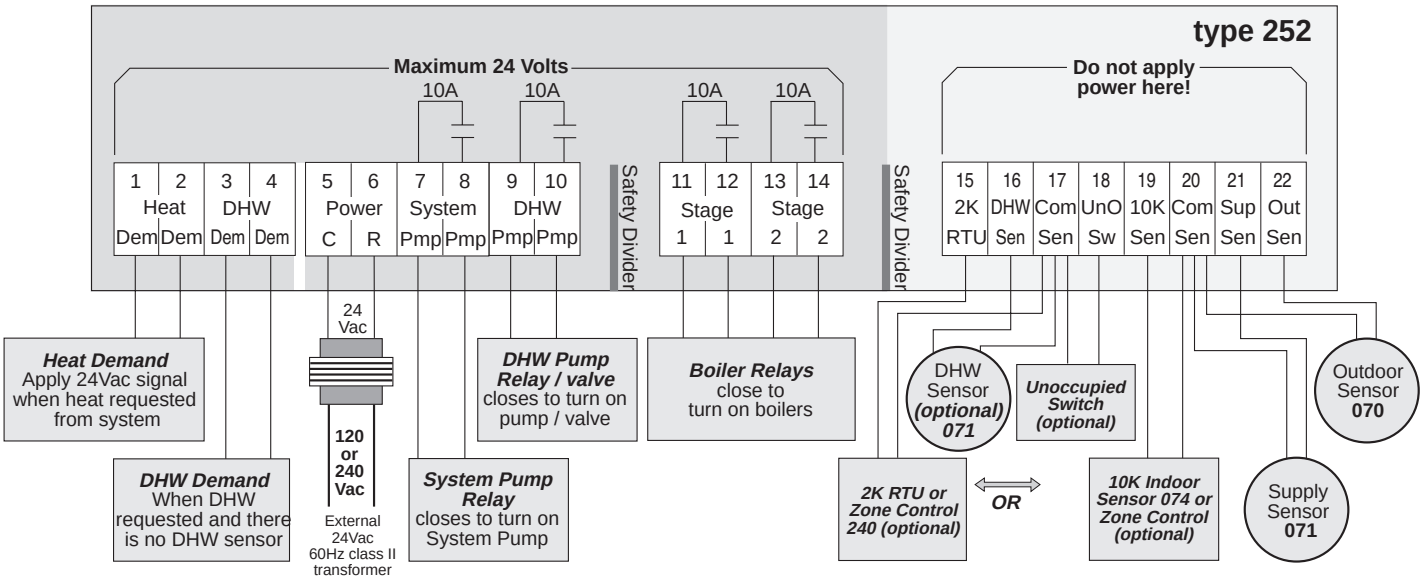



*Option: Occupied/Unoccupied switch input:*

Connect the two wires from the Occupied/Unoccupied dry contact switch (timer, relay, etc.) to terminals *Com Sen — UnO Sw* (17 and 18).




**Electrical connections to the terminal plugs of the 252 control. Control relays are shown in "power down" condition.**

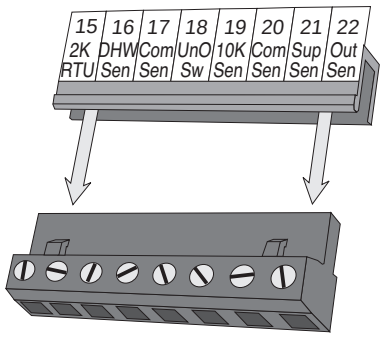



## *For a detailed wiring schematic of your specific application, refer to the Application Brochure A 252.*

## Step Five — Testing the wiring

***Caution***

- **These tests are to be performed using standard testing practices and procedures and should only be carried out by a properly trained and experienced technician.**
- **Before applying power to the control for testing, each terminal plug must be unplugged from its header on the control. Pull straight down to unplug.**
- **A good quality electrical test meter, capable of reading from at least 0 — 200 Volts AC, and at least 0 — 1,000,000 Ohms, is essential to properly test this control.**




**Terminal plug disconnected from its header on the control**

*Test the sensors*

- These tests must be made *before* turning on the power supply, and with the terminals unplugged.
- The sensors are to be tested according to the instructions in Brochure D 001.

*Test the power supply*

Make sure exposed wiring or bare terminals are not in contact with any other wires or grounded surfaces. Turn on the power to the transformer and use an AC voltmeter to measure the voltage between terminals *C — R* (5 and 6). 22 to 26 Volts AC should be measured at these terminals.

*Test the powered inputs*

If an external Heat Demand signal is used, power up the Heat Demand circuit and supply a Heat Demand signal to the control. Use an AC voltmeter to measure the voltage between terminals *Heat Dem — Heat Dem* (1 and 2). 22 to 26 Volts AC should be measured at these terminals.

If a DHW Demand signal is used, power up the DHW Demand circuit and supply a DHW Demand signal to the control. Use an AC voltmeter to measure the voltage between terminals *DHW Dem — DHW Dem* (3 and 4). 22 to 26 Volts AC should be measured at these terminals.

If a System Pump circuit is connected to the *Sys Pmp — Sys Pmp* (7 and 8) terminals; make sure power to the circuit is off and install a jumper in the terminal plug between terminals 7 and 8. When the circuit is powered-up, the pump should operate. If it does not come on, check the circuit wiring for errors and ensure that it is powered up and the voltage is correct. Check the devices in the circuit (pump, switching relay, etc.) for faults. If the pump operates properly when the circuit is powered up, disconnect the power and remove the jumper. Repeat this step for the DHW pump / valve circuit.

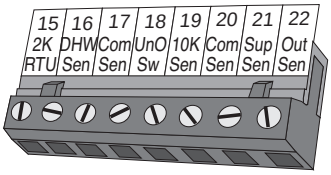
Make sure power to the Boiler circuit is off and install a jumper in the terminal plug between the *Stage 1*(11 and 12) terminals. When the circuit is powered-up, the boiler should operate. If it does not come on, check the circuit wiring for errors and ensure that it is powered up and the voltage is correct. Check the devices in the circuit (limits, flow switches, etc.) for faults. If the boiler operates properly when the circuit is powered up, disconnect the power and remove the jumper. Repeat for Stage 2.

*Connect the control*

**Turn the power off and make sure all test jumpers have been removed from the plugs.**

Connect the plugs to the control by carefully aligning them with their respective headers and pushing them upwards into the headers. The plugs should snap firmly into place.

The control is now ready for set-up and operation.




**Terminal plug pushed into its header on the control**

***Caution***

**The tekmar Two Stage Boiler & DHW Control 252 is an operating control and is not certified or intended for use as a safety device. Under no circumstances should safety limit devices be left disconnected after installation of this control. The installer shall check all applicable code requirements and obtain necessary inspections to ensure that the installation is in compliance with those requirements.**

## Settings

### Step Six — Essential control settings

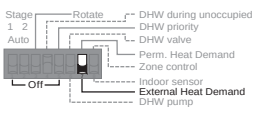
**To obtain the best operation from a reset control, it is important to measure the system supply temperature as accurately as possible. Whenever the control receives a heat demand signal, the system pump must be operated to maintain continuous water flow past the supply temperature sensor.**

For specific application details refer to Application Brochure A 252.

A more detailed technical description of the effect of control settings on overall system operation is described in the tekmar Essay E 002.

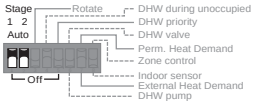
*Heat Demand switch*

When the heating system uses zone valve end switches or some other means of delivering an external heat demand signal to terminals *Heat Dem — Heat Dem* (1 and 2), set this selector switch to "External (1 & 2)" and the control will be enabled when it receives a 24Vac signal from the heat demand circuit. *If an external heat demand signal is not used, set the switch to "Permanent".*



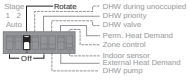

*Stage 1 & 2 Auto or Off switch*

When a Stage switch is set to "Auto", that stage becomes active and its boiler is available. If the Stage switch is "Off", the control will ignore that stage and not turn it on.



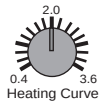

*Rotate switch*

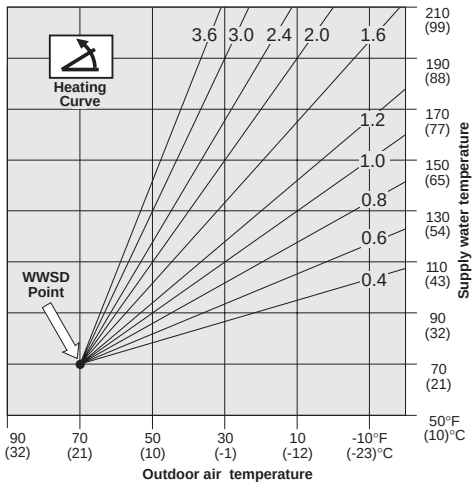
When set to "Rotate", the firing order of the boilers will change whenever one stage accumulates 48 hrs more running time than the other. When set to "Off", Stage 1 is always the lead boiler.



*Heating Curve*

As outdoor temperatures drop, heat losses from a space become greater and the heating system supply water temperature must be raised to maintain a constant room temperature. The heating curve value describes how many degrees the supply water temperature is raised for a one degree drop in outdoor temperature. The supply temperature starts to increase when the outdoor temperature falls below the WWSD point. To calculate the correct setting for the Heating Curve, use the following formula.




**Heating Curve = $\frac{\text{design supply temperature – room temperature}}{\text{room temperature – design outdoor temperature}}$**

**For example:**
- **design outdoor temperature = 5°F (-15°C)**
- **room temperature = 70°F (21°C)**
- **design supply temperature = 160°F (71°C)**

**Heating Curve = $\frac{160°F - 70°F}{70°F - 5°F}$ = $\frac{90°F}{65°F}$ = 1.4**

For more information regarding the Heating Curve, refer to page 2 of this brochure. If the actual designed supply water temperature for a system is unknown, a trial setting can be calculated using these typical supply temperatures:

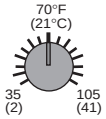
• Fan coils …180° to 210°F (82° to 99°C) • Baseboards …160° to 190°F (71° to 88°C) • Radiant floors …100° to 130°F (38° to 54°C).

*Occupied temperature*

When there is no room temperature feedback to the control, the Occupied dial setting determines the starting point of the heating curve (WWSD point) and the Heating Curve setting will reset the water temperature as described in the Heating Curve instructions above.

When an Indoor Sensor 074 is connected to the control, the Occupied dial setting becomes the actual controlled temperature of the room. This feature will help the control compensate for an incorrectly set heating curve or for unexpected internal heat gains or losses. If the room temperature is too high or too low, the indoor sensor allows the heating curve to be shifted up or down accordingly.

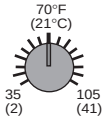
When a tekmar Zone Control or 2K RTU (Room Temperature Unit) is connected to the control, the RTU setting becomes the controlled temperature and the Occupied dial becomes inactive.




*Unoccupied temperature*

The Unoccupied dial operates in the same way as the Occupied dial.

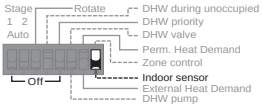
When the terminals *Com Sen — UnO Sw* (17 and 18) are shorted out, the control switches from operating at the Occupied dial setting to operating at the Unoccupied dial setting. When a tekmar Zone Control or 2K RTU (Room Temperature Unit) is connected to the control, the RTU setting becomes the controlled temperature and the Unoccupied dial becomes inactive.




*Zone Control/Indoor Sensor switch*

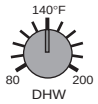
When this selector switch is in the "Indoor Sensor" position, and a tekmar Indoor Sensor 074 or a tekmar 2K RTU is connected, the control receives room temperature feedback from the RTU or Indoor Sensor and the Occupied/Unoccupied dials operate as described above.

When the switch is in the "Zone Control" position, and a tekmar Zone Control is connected, the control receives information from the Zone Control that allows the heating curve to be shifted so the supply water temperature is hot enough to satisfy the requirements of the zone with the highest heat demand.



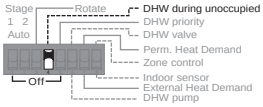

*DHW*

When the control receives a DHW Demand signal from either a DHW Sensor or from 24V applied to the DHW Dem terminals, the control will operate in the DHW mode. *See DHW operation, pg. 4*



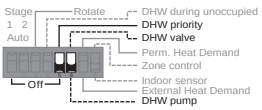

*DHW during Unoccupied mode*

When this selector switch is in the "On" position, DHW will continue to be generated when the control is switched into the Unoccupied mode and a DHW Demand signal is received. When the switch is in the "Off" position, the DHW mode becomes inactive when the control is in Unoccupied mode and the control will ignore any DHW Demand signal.




*DHW Priority switch*

When this selector switch is in the "On" position, DHW generation will be given priority over heating operation when a DHW Demand signal is received. When the switch is in the "Off" position, DHW generation is simultaneous with heating operation. *See Application Brochure A 252.*

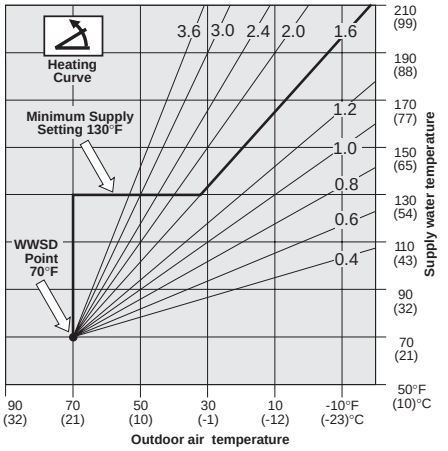



*DHW Valve/Pump switch*

Set this selector switch to the "Valve" position when a valve is used in DHW generation and the "Pump" position when using a pump. *See Application Brochure A 252.*

*Minimum Supply Temperature*

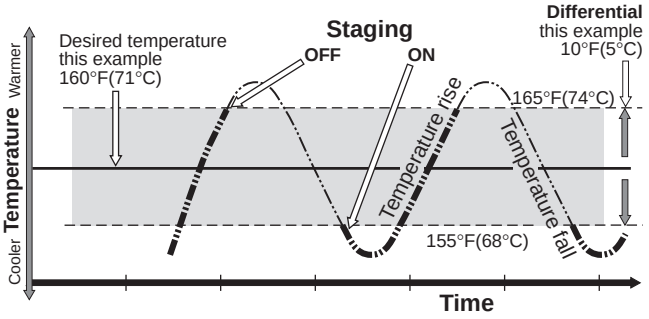
This dial should be set according to the requirements specified by the boiler manufacturer. Many boilers require a minimum operating temperature to prevent corrosion from flue gas condensation. The control raises the supply temperature to the Minimum setting when the outdoor temperature drops below the WWSD point, and holds it there until the outdoor temperature becomes cold enough to require operation on the heating curve. When an Indoor Sensor 074 or 2K RTU is installed in a room and the selector switch set for "Indoor Sensor", the control will cycle the boiler on and off at the Minimum Supply temperature to prevent overheating of the room.


Typical Minimum Boiler Operating Temperatures: • Steel Tube Boilers …140° to 180°F (60° to 82°C) • Cast Iron Boilers …130° to 150°F (54° to 66°C) • Copper Tube Boilers …105° to 150°F (41° to 66°C) • Condensing or Electric Boilers …Off

*Boiler Differential*

The Boiler Differential adjustment sets how much the actual supply water temperature may deviate from the desired temperature before stages are turned on or off, and is determined by the flow rate past the supply sensor relative to the amount of heat produced by each stage. To prevent short operating cycles of the boiler(s) the control has a delay of at least 1 minute between firing cycles. On an installation where flow rates are known, the Boiler Differential can be calculated as follows:

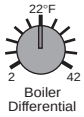



**Boiler Differential = $\frac{\text{Btu/hr}}{\text{US GPM x 500}}$**

**For example: $\frac{\text{100,000 Btu/hr}}{\text{20 US GPM x 500}}$ = 10°F (6°C)**

**Trial setting = 22°F if flow rates are unknown**

**All boilers will eventually turn on when the temperature falls 5°F (3°C) below the desired temperature. Delays of 1 to 5 minutes for staging on depend on the degree of control error. All boilers eventually turn off when the temperature rises 5°F (3°C) above the desired temperature. Delays of 8 seconds to 3 minutes for staging off depend on the degree of control error. Within the differential range, no boilers are staged on or off.**




*Test button*

The control can be made to cycle through a test routine whenever the Test button is pushed. The test can be halted at certain times by pushing the button a second time. For details of the test routine, refer to the description starting on page 10.


*Indicator lights*

There are eleven LEDs on the front of the control that will aid in testing and troubleshooting. During normal operation, these lights indicate the following functions:

| | |
|---|---|
| *Power light on* | • the 24Vac power supply has been connected and the control is energized. |
| *Heat Demand light on* | • the control is receiving a 24Vac external Heat Demand signal at terminals *Heat Dem — Heat Dem* (1 and 2) or the Heat Demand selector switch is in the "Permanent" position or a 10K Zone Control causes a Heat Demand. |
| *DHW Demand light on* | • the control is receiving a 24Vac DHW Demand signal at terminals *DHW Dem — DHW Dem* (3and 4) or a DHW sensor is connected and has determined a need for DHW generation. |
| *WWSD light on* | • the outdoor temperature is above the WWSD point and the control has shut the heating system off. |
| *Unoccupied light on* | • the terminals *Com Sen — Uno Sw* (17 and 18) are shorted together, switching the control into Unoccupied (setback) mode. |
| *Minimum light on* | • the control has calculated that it must operate the boiler(s) to maintain the Minimum Supply temperature since the outdoor temperature is not cold enough for Heating Curve operation. |
| *System pump light on* | • the system pump relay is on, closing the contacts between terminals 7 & 8. |
| *DHW pump light on* | • the DHW pump/valve relay is on, closing the contacts between terminals 9 & 10. |
| *Stage 1 or 2 light on* | • a boiler relay is on, closing the contacts between terminals 11 & 12 or 13 & 14. |
| *Test light on / flashing* | • the control is going through the programmed test routine / is halted. |

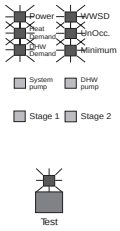
## Testing the Control Functions

### Step Seven — Operational test of control functions - Test button

The Two Stage Boiler & DHW Control 252 has a Test button which can be used to test all of the main control functions at any time. When the control is initially powered-up, or when the Test button is pushed, the control automatically runs through the following test procedure. If a fault is detected, some of the indicator lights will flash an Error Message. These Error Messages are listed on page 11.

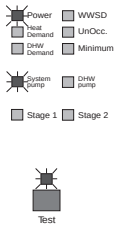
*All red lights on*

On power-up, and at the start of each test routine, all of the red status lights are switched on for approximately 5 seconds. During this time the control searches for sensor faults and, if no faults are found, proceeds to the next step. If a sensor fault exists, the control exits the test routine and indicates the fault by flashing some of the lights in an error message. These Error Messages are listed on page 11.



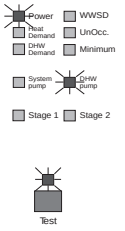

*Power light on - Test light on - System Pump light on*

The control turns on the System pump for 10 seconds and: **(a)** — proceeds to the next step, *OR* **(b)** — During the 10 seconds, *if there is a Heat Demand signal **and** the Test button is pressed,* the test routine will be halted, the "Test" light will flash, and the control will be held in a pause mode for up to 5 minutes. During the 5 minutes, the System pump will remain on. After the 5 minutes, the control will automatically exit the test routine and enters the normal operating mode. If there is no Heat Demand, the control will not allow a pause and will proceed to the next step of the test routine. Pushing the Test button during the 5 minute pause will allow the control to proceed to the next step of the test routine immediately.



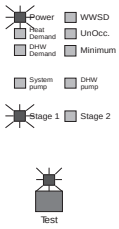

*Power light on - Test light on - DHW Pump light on*

The control turns on the DHW pump for 10 seconds and: **(a)** — cycles to the next step, *OR* **(b)** — During the 10 seconds, *if there is a DHW Demand signal, **and** the Test button is pressed,* the test routine will be halted, the "Test" light will flash, and the control will be held in a pause mode for up to 5 minutes. During the 5 minutes, the DHW pump will remain on. After the 5 minutes, the control will automatically exit the test routine and enters the normal operating mode. If there is no DHW Demand, the control will not allow a pause and will proceed to the next step of the test routine. Pushing the Test button during the 5 minute pause will allow the control to proceed to the next step of the test routine immediately.




*Power light on — Test light on — Stage 1 light on*

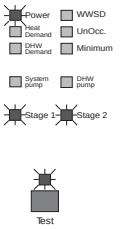
If there is a Heat Demand the system pump will be turned on or if there is a DHW Demand the DHW pump will be turned on; the control turns on stage 1 for 10 seconds and: **(a)** — cycles to the next step, *OR* **(b)** — During the 10 seconds, *if there is a Heat Demand or DHW Demand signal, **and** the Test button is pressed,* the test routine will be halted, the "Test" light will flash, and the control will be held in a pause mode for up to 5 minutes. During the 5 minutes, the pump and Stage 1 will remain on. After the 5 minutes, the control will automatically exit the test routine and enters the normal operating mode. If there is no Heat Demand or DHW Demand, the control will not allow a pause and will proceed to the next step of the test routine. Pushing the Test button during the 5 minute pause will allow the control to proceed to the next step of the test routine immediately.




***Heat Demand and/or DHW Demand lights may also be on. If the Heat demand light is on, the System Pump and System Pump light will remain on. If the DHW demand light is on, the DHW Pump and DHW Pump light will remain on.***

*Power light on — Test light on — Stage 1 light on — Stage 2 light on*

The control leaves Stage 1 on, turns on Stage 2 for 10 seconds and: **(a)** — proceeds to the next step, *OR* **(b)** — During the 10 seconds, *if there is a Heat Demand or DHW Demand signal, **and** the Test button is pressed,* the test routine will be halted, the "Test" light will flash, and the control will be held in a pause mode for up to 5 minutes. During the 5 minutes, the pump and Stage 1 & 2 will remain on. After the 5 minutes, the control will automatically exit the test routine and enters the normal operating mode. If there is no Heat Demand or DHW Demand, the control will not allow a pause and will exit the test routine, entering the normal operating mode. Pushing the Test button during the 5 minute pause will allow the control to exit the test routine immediately.




*Note;*

*Whenever the control exits the test routine, there is an automatic 4 second delay before the control can be made to re-enter the test routine. Pushing the Test button during this 4 second period will have no effect on the control.*

*Power light on — Test light off*

The control has exited the test routine, entered the operating mode and will function according to the sequence of operation described on pages 3 and 4. *One or more of the other indicator lights may also be on.* Refer to pages 3 and 4 for a description of the indicator lights under operating conditions.

## Step Eight — Troubleshooting

As in any troubleshooting procedure, it is important to isolate a problem as much as possible before proceeding. The Error Messages and the Test button greatly simplify troubleshooting of the 252.

If a fault occurs during operating mode or during the test routine and the control is flashing an Error Message, identify the fault from the look-up table at the bottom of this page and then follow standard testing procedures to confirm the problem.

If you suspect a wiring fault, return to steps four and five and carefully check all external wiring and wiring connections.

Notes:

If the Outdoor Sensor develops either a short circuit or an open circuit, the control is programmed to calculate the outdoor temperature at -8°F (-22°C) and control the supply temperature accordingly.

The control is programmed to shut the boiler(s) down before the supply temperature can reach a maximum allowable supply water temperature of 248°F (120°C).

If the Supply Sensor develops either a short circuit or an open circuit, the control is programmed to shut down the boiler(s) and run the System Pump to prevent overheating.

If there is an uninterrupted DHW Demand for 8 hours and the outdoor temperature is below 34°F(2°C) an error message will be given. The control will operate in the heating mode and any DHW Demand is ignored. To remove the error message after the DHW system fault has been corrected, the control must be powered down.

If an Indoor Sensor or RTU input becomes shorted out, the Occupied and Unoccupied dial settings will become active.

**After any repair has been completed, press the Test button to allow the control to cycle through the test routine. This will allow you to confirm that correct operation has been restored.**

## Step Nine — Before you leave

Install the wiring cover over the wiring chamber and secure it to the base with the two screws provided. Place the front cover on the control to cover the setting dials and snap it into place. Install a lock if security is required.

Place this brochure, and all other brochures relating to the installation, in the protective plastic bag supplied with the control. Place the bag in a conspicuous location near the control for future reference.

It is important to explain the operation and maintainance of this control and of the system to the end user and anyone else who may be operating the system.

## Error Messages

Whenever a fault is detected in any of the sensors, the indicator lights will flash in specific ways to indicate the problem.

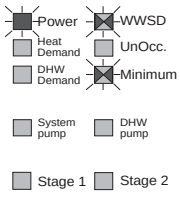
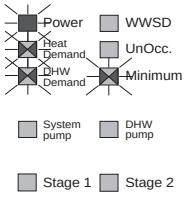
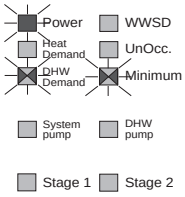
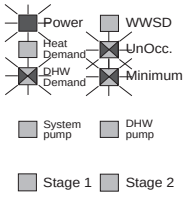
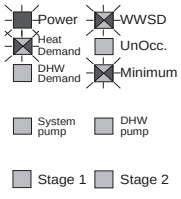
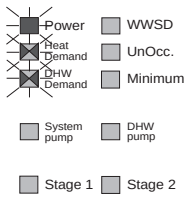
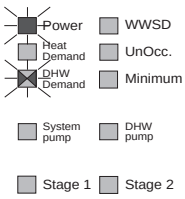
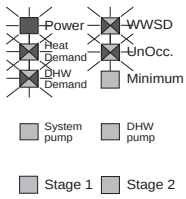
The following look-up table describes each error condition and shows the flashing light sequence that results.

After repairing the problem, press the test button to cycle the control through the test routine and confirm that the fault has been repaired and that correct control action has been restored.

For detailed Sensor testing instructions see Data Brochure D 001.

*Some or all of the yellow output LEDs may also be on depending on the cause of the error. (see troubleshooting notes)*

Light on continually  Light flashing  Light off 

| | | | | |
|---|---|---|---|---|
| 10K Indoor Sensor short circuit  | Supply Sensor short circuit (see trouble-shooting notes)  | Outdoor Sensor short circuit (see trouble-shooting notes)  | DHW Sensor short circuit (see trouble-shooting notes)  | |
| 2K RTU short circuit  | Supply Sensor open circuit (see trouble-shooting notes)  | Outdoor Sensor open circuit (see trouble-shooting notes)  | DHW System Fault occurs with 8 Hrs. of continuous DHW demand when Outdoor temp is less than 34°F. (see trouble-shooting notes)  | |

## Technical Data

**Technical Specifications**

| | | |
|---|---|---|
| Dimension (h x w x d) | — | 6-5/8" x 7-9/16" x 2-13/16" (170 x 193 x 72mm) |
| Weight | — | 2.9 lbs (1.3 Kg) |
| Ambient | — | 30 to 120°F (0 to 50°C), < 95% RH non-condensing |
| Power supply | — | 24Vac ± 10%, 60Hz, 3VA class II |
| Relay capacity | — | SPST, 24Vac, 10 Amps |
| Sensors | — | Sensor 071, Outdoor Sensor 070. Accurate with up to 500 feet (150m) 18AWG cable |
| Control accuracy | — | ± 1°F (± 0.5°C) |

This electronic control does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications. Le présent numérique n'émete pas de bruits radioeléctriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le réglement sur le brouillace radioeléctrique édicté par le Ministére des Communications du Canada.

**Features**

| | | |
|---|---|---|
| 11 Indicator lights | — | Power, Heat Demand, DHW Demand, WWSD, Unoccupied, Min. Supply, System Pump, DHW Pump, Stage 1, Stage 2, Test |
| System pump output | — | Isolated SPST relay contacts close when heating is required |
| DHW pump output | — | Isolated SPST relay contacts close on DHW Demand |
| Stage 1 & 2 output | — | Isolated SPST relay contacts close to operate each stage |
| Test button | — | Initiates and controls pre-programmed test run |
| Error message display | — | Sensor faults are indicated by flashing light codes |

**Settings**

| | | |
|---|---|---|
| Heating Curve | — | 0.4 to 3.6 |
| DHW temperature | — | 80 to 200°F (27 to 93°C) |
| Minimum Supply | — | Off, 80 to 170°F (Off, 27 to 77°C) |
| Boiler Differential | — | 2 to 42°F (1 to 23°C) |
| Occupied | — | 35 to 105°F (2 to 41°C) |
| Unoccupied | — | 35 to 105°F (2 to 41°C) |
| Stage 1 switch | — | To switch Stage 1 off or into operating mode |
| Stage 2 switch | — | To switch Stage 2 off or into operating mode |
| Rotate switch | — | To allow boilers to rotate firing sequence based on hours of use |
| DHW Unoccupied switch | — | Generation/No generation of DHW during Unoccupied mode |
| DHW Priority switch | — | To make generation of DHW have priority over heating operation |
| DHW valve/pump switch | — | Selected for the type of device used when generating DHW |
| Heat Demand switch | — | External 24Vac signal or permanent internal signal |
| Zone Control/Sensor switch | — | Input from tekmar Zone Control or Indoor Sensor 074 |

## Limited Warranty and Product Return Procedure

**Limited Warranty:** tekmar warrants to the original purchaser each tekmar product against defects in workmanship and materials when the product is installed and used in compliance with tekmar's instructions. This limited warranty covers the cost of parts and labour provided by tekmar to correct defects in materials and/or workmanship. Returned products that are fully operational are not considered a warranty case. tekmar also does not cover parts or labour to remove, transport or reinstall a defective product. tekmar will not be liable for any damage other than repair or replacement of the defective part or parts and such repair or replacement shall be deemed to be the sole remedy from tekmar. This warranty shall not apply to any defects caused or repairs required as a result of unreasonable or negligent use, neglect, accident, improper installation, or unauthorised repair or alterations. In case of defect, malfunction or failure to conform to warranty, tekmar will, for a warranty period of 24 months from the date of invoice to the original purchaser or 12 months from the date of installation of the product, whichever occurs first, repair, exchange or give credit for the defective product. Any express or implied warranty which the purchaser may have, including merchantability and fitness for a particular purpose, shall not extend beyond 24 months from the date of invoice or 12 months from the date of installation of the product, whichever occurs first.

**Replacements:** tekmar can send replacement products if requested. All replacements are invoiced. Any possible credit for the replacement will only be issued once the replaced product has been returned to tekmar.

**Product Return Procedure:** Products that are believed to have failed must be returned to tekmar Control Systems Ltd. 4611-23rd Street, Vernon B.C. Canada V1T 4K7 when agreed to by tekmar. The installer or other qualified service person must, at the owner's expense, determine which component has failed. The product must be returned complete with all of itscomponents (sensors, base, etc.). Products must be returned together with the proof of purchase to the original purchaser who then returns the product to tekmar after receiving a Return Goods Authorisation (RGA) number from tekmar.

Please include the following information with the product: The full address of the original purchaser, the RGA number and a description of the problem.

From the U.S.A., in order to avoid customs charges, products must be returned via US Post with the package clearly marked with the RGA number, product type and the statement "Canadian Product returned for repair". For shipping purposes the product can be valued at one half list price.

1) If returned during the warranty period and the product is defective, tekmar will issue full credit for the returned product less cost of missing parts.
2) If returned during the warranty period and the product is fully operational, tekmar will return the product to the original purchaser for a testing cost of $30.00 plus postage.
3) If returned during the warranty period and the product is not damaged and is fully operational, tekmar can take back the product for a return charge of 40% of the product's net value. This request has to be specified otherwise the product will be returned with a testing cost of $30.00 plus postage.
4) If returned after the warranty period and the product needs repair, tekmar will repair and return the product. Repair and postage costs will be invoiced. tekmar's repair costs are calculated at $30.00 / hour plus the cost of parts. If the repair costs will be more than $60.00 a repair estimate will be sent to the original purchaser.

**In North America:** tekmar Control Systems Ltd ., Canada
tekmar Control Systems, Inc., USA
Head office: 4611 - 23rd Street
Vernon, B.C. Canada V1T 4K7
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